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TITLE: Manufacture of 1-indanone as intermediate raw materials,
involves oxidizing indan in organic solvent by oxygen/oxygen containing gas in presence of transition metal-bromine type catalyst at preset temperature

PATENT-ASSIGNEE: ADCHEMCO CORP[ADCHN]

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PATENT-FAMILY:

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ABSTRACTED-PUB-NO: JP2001247505A

BASIC-ABSTRACT:

NOVELTY - 5-20 weight % of indan (indan and its substituted derivatives) is oxidized in an organic solvent solution by an oxygen or oxygen containing gas in presence of a transition metal-bromine type catalyst at 15-30 deg. C. The atomic ratio of cobalt to manganese in the transition metal catalyst is 4 or more.

USE - As intermediate raw materials such as pharmaceutical and agro-

chemicals.

ADVANTAGE - The indan is oxidized in mild condition to yield high conversion ratio and 1-indanone selectivity, hence mass production of 1-indanone is inexpensive.

CHOSEN-DRAWING: Dwg.0/0

TITLE-TERMS: MANUFACTURE INDANONE INTERMEDIATE RAW MATERIAL INDANE ORGANIC

SOLVENT OXYGEN OXYGEN CONTAIN GAS PRESENCE TRANSITION
METAL BROMINE
TYPE CATALYST PRESET TEMPERATURE

DERWENT-CLASS: B05 C03 E14

CPI-CODES: B10-F02; C10-F02; C11-C01; E10-F02A1; N02; N03; N04-D01;

CHEMICAL-CODES:

Chemical Indexing M2 *01*

Fragmentation Code

G031 G211 J5 J561 M280 M320 M414 M510 M520 M531

M540 M720 M904 M905 N209 N224 N343 N441 N512

Specific Compounds

A14T1K A14T1P

SECONDARY-ACC-NO:

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(21)Application number : 2000-062535 (71)Applicant : ADCHEMCO CORP

(22)Date of filing : 07.03.2000 (72)Inventor : MORI HIROAKI
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(54) METHOD OF PRODUCING 1-INDANONES

(57)Abstract:

PROBLEM TO BE SOLVED: To provide the subject method high in both indane invert ratio and selectivity for 1-indanone.

SOLUTION: This method of producing 1-indanone comprises oxidation of indanes in the form of an organic solvent solution with oxygen or an oxygen- containing gas in the presence of a transition metal-bromine-based catalyst wherein it is characteristic that the indane concentration of the indane solution is 5-20 wt.%, the atom ratio Co/Mn in the catalyst is ≥ 4 , and the reaction temperature is adjusted to 15-30°C.

LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of 1-Inn Danone which in oxidizing by oxygen or oxygen content gas under existence of the catalyst of a transition-metals-bromine system in the indans in an organic solvent solution, and manufacturing 1-Inn Danone makes indans concentration of an indans solution 20 or less % of the weight 5% of the weight or more, make the atomic ratio of Co/Mn of the above-mentioned transition metal catalyst four or more, and are characterized by adjusting reaction temperature to 15 degrees C or more 30 degrees C or less.

[Claim 2] The manufacture approach of 1-Inn Danone according to claim 1 which use lower fatty acid as an organic solvent.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Field of the Invention] This invention relates to the approach of manufacturing industrially 1-Inn Danone useful as middle raw materials, such as physic and agricultural chemicals, advantageously from indans. In addition, in this invention, "indans" means an indan and its permutation derivative, and "1-Inn Danone" means 1-Inn Danone and its permutation derivative.

[0002]

[Description of the Prior Art] As the manufacture approach of conventional 1-Inn Danone, it considers as 1-chloro indan through hydrogen chloride gas at the approach and (2) indenenes which carry out the ring closure of the (1)3-phenyl propionic acid to the bottom of catalyst existence, such as an aluminum chloride, and the approach of subsequently oxidizing using a chromic acid, the approach of oxidizing the indan obtained by carrying out hydrogenation of the (3) indenenes, etc. are learned.

[0003]

[Problem(s) to be Solved by the Invention] The approach of the above (1) has the problem that it is difficult for 3-phenyl propionic acid to come to hand cheaply. Moreover, the approach of the above (2) has the problem of using the large chromic acid of an environmental load. Then, the approach which is going to oxidize the indan obtained by carrying out hydrogenation of the indene like the approach of the above (3), and is going to compound 1-Inn Danone is examined. For example, fusibility chromium salt and/or cobalt salt are made into a catalyst, and the method of manufacturing 1-Inn Danone under existence of N and N-dialkyl fatty-acid amide is learned (JP,56-32439,A). This approach has low 1-Inn Danone selectivity, when an indan invert ratio is high, and on the other hand, when making selectivity high, it has the problem that an invert ratio must be made low.

[0004] Moreover, although an invert ratio and selectivity have the advantage of being good, the pressure of reaction time is 30kg/cm², a severe reaction condition called 100-degree-C order is required for the approach (JP,9-136859,A) of making fusibility chromium salt and/or cobalt salt into a catalyst, and manufacturing 1-Inn Danone under N-alkyl fatty-acid amide existence, and it is not desirable [this reaction] from an activity safety aspect. Moreover, under existence of the transition metal catalyst of chromium, manganese, etc. and aldehydes, both the approaches (JP,5-246914,A) on which oxygen is made to act have the invert ratio of an indan, and the low selectivity to 1-Inn Danone, and are hard to be called practical approach. Therefore, the purpose of this invention is offering the manufacture approach of 1-Inn Danone which canceled the trouble in the above-mentioned conventional technique.

[0005]

[Means for Solving the Problem] this invention person resulted in this invention, as a result of repeating examination that the trouble of the above-mentioned conventional technique should be solved. This invention the indans in an organic solvent solution Namely, under existence of the catalyst of a transition-metals-bromine system, In oxidizing by oxygen or oxygen content gas, and manufacturing 1-Inn Danone The manufacture approach of 1-Inn Danone which makes indans concentration of an indans solution 20 or less % of the weight 5% of the weight or more, make the atomic ratio of Co/Mn of the

above-mentioned transition metal catalyst four or more, and are characterized by adjusting reaction temperature to 15 degrees C or more 30 degrees C or less is offered.

[0006] According to the approach of this invention, the invert ratio of the indans which are a raw material is raised, on the other hand, the by-product of 1-indanol can be reduced and 1-Inn Danone can be manufactured by high yield.

[0007]

[Embodiment of the Invention] The gestalt of operation desirable next is mentioned and this invention is explained in more detail. The indans used as a raw material by this invention are an indan or its permutation derivative. The permutation derivatives of an indan are 1 of the alicycle of an indan, the 2 or 3rd place and 4 of the benzene ring, 5, and the compound that has a substituent in the 6 or 7th place at least one, and 1-methoxy indan, 1, 2-dimethoxy indan, 3, 4-dimethoxy indan, 4-chloro indan, 4-nitro indan, 1-methyl indan, 2-methyl indan, 2-phenyl indan, etc. can specifically be mentioned.

[0008] In this invention, it oxidizes in an organic solvent in indans. It is desirable to use lower fatty acid well-known as an organic solvent to be used. For example, as for a formic acid, an acetic acid, a propionic acid, butanoic acid, an isobutyric acid, a valeric acid, an isovaleric acid, a caprylic acid, etc., it is specifically desirable a with a carbon number of about one to six fatty acid and to be able to mention those mixture and to use an acetic acid substantially.

[0009] The indans concentration of the indans solution which is a raw material is 20 or less % of the weight 5 % of the weight or more as the above-mentioned lower-fatty-acid solution, and is 10 or less % of the weight 5 % of the weight or more more preferably. If indans concentration exceeds 20 % of the weight, the byproduction of about [that the invert ratio of indans falls] and 1-indanol will become remarkable. On the other hand, if it becomes less than 5% of the weight, it is not desirable in order for the productive efficiency of 1-Inn Danone to fall.

[0010] The transition-metals-bromine system catalyst used by this invention is easy to be the well-known thing currently used industrially. Specifically, it is desirable like the acetate of transition metals, such as cobalt, manganese, and a cerium, a nitrate, etc. to be the thing of fusibility, to make a cobalt compound and a manganese compound indispensable, and to use a kind or the thing combined two or more sorts for an indans solution otherwise.

[0011] The rate of an use rate of a cobalt compound and a manganese compound of carrying out to four or more as Co/Mn (atomic ratio) is good. If Co/Mn becomes less than four, since oxidation reaction advances further, association of the alicycle part of an indan frame cleaves and generation of a carboxylic-acid derivative increases, it is not desirable. The amount of the transition-metals salt used is 0.1 mols or less as the total number of mols of per [which is a raw material] one mol of indans, and a transition-metals salt, and is 0.03 mols or more 0.07 mols or less preferably.

[0012] Although the bromine compound which constitutes a catalyst system can illustrate a sodium bromide, an ammonium bromide, etc. as what can supply bromine ion, the amount used is good to be referred to as 0.5-2.0 as a bromine/transition metals (atomic ratio). If there is too little bromine, a reaction rate will fall, and on the other hand, when many [too], there is an inclination which a by-product increases.

[0013] Reaction temperature is held at 15 degrees C - 30 degrees C, and 20 degrees C - its 25 degrees C are especially desirable. If reaction temperature exceeds 30 degrees C, the alicycle part of indans cleaves, a carboxylic-acid derivative will generate, or heavy-ization of the indans which are a raw material will be promoted, and the selectivity of a reaction will fall. When solution temperature rises by oxidation reaction, it is desirable by cooling to maintain predetermined temperature for reaction mixture. Although reaction time changes with reaction temperature, it is about 1 - 50 hours in the above-mentioned reaction temperature requirement.

[0014] Although the exhaust gas of pure oxygen, air, and other oxygen content can be used for the molecular oxygen content gas used as an oxidizer, it is satisfactory in any way with the usual air. Any approach of a batch process and continuous system is possible for the reaction format of this invention. Separation purification of target 1-Inn Danone can be easily performed by applying distillation and the approach that recrystallization etc. is still better known from a resultant.

[0015]

[Example] Although an example and the example of a comparison are given next and this invention is explained still more concretely, thereby, this invention is not limited at all.

Indan 12.0g (98.0% of purity, 0.1 mols), 1.35g (5.4 millimol) of cobaltous acetate (II)4 hydrates, 0.15g (0.6 millimol) of manganese acetate (II)4 hydrates, 0.91g (8.8 millimol) of sodium bromides, and 90.4g of acetic acids are prepared, and it was made to react to 100ml flask furnished with example 1 agitator, a thermometer, gas blowing-in tubing, and a reflux cooling pipe with the reaction temperature of 20 degrees C for 12 hours, circulating air at a rate of 100ml/m. After reaction termination, when the gas chromatography analyzed this reaction mixture, 1-Inn Danone selectivity of the invert ratio of an indan was 85.7% 98.2%. 1-Inn Danone / 1-indanol (mole ratio) was 11.3.

[0016] It carried out by the same approach as an example 1 except having carried out 1.23g (12 millimol) use of the example 2 sodium bromide. A result is shown in Table 1.

[0017] As example 3 catalyst, it carried out by the same approach as an example 1 except having used 0.90g (3.6 millimol) of cobaltous acetate (II)4 hydrates, 0.10g (0.4 millimol) of manganese acetate (II)4 hydrates, and 0.82g (8 millimol) of sodium bromides. A result is shown in Table 1.

[0018] As example 4 catalyst, it carried out by the same approach as an example 1 except having carried out 1.44g (5.8 millimol) of cobaltous acetate (II)4 hydrates, 0.05g (0.2 millimol) of manganese acetate (II)4 hydrates, and 1.23g (12 millimol) use of sodium bromides. A result is shown in Table 1.

[0019] As example 5 catalyst, it carried out by the same approach as an example 1 except having carried out 1.39g (5.6 millimol) of cobaltous acetate (II)4 hydrates, 0.10g (0.42 millimol) of manganese acetate (II)4 hydrates, and 1.23g (12 millimol) use of sodium bromides. A result is shown in Table 1.

[0020] As example 6 catalyst, it carried out by the same approach as an example 1 except having carried out 1.27g (5.1 millimol) of cobaltous acetate (II)4 hydrates, 0.22g (0.9 millimol) of manganese acetate (II)4 hydrates, and 1.23g (12 millimol) use of sodium bromides. A result is shown in Table 1.

[0021] As example 7 catalyst, it carried out by the same approach as an example 1 except having carried out 1.20g (4.8 millimol) of cobaltous acetate (II)4 hydrates, 0.29g (1.2 millimol) of manganese acetate (II)4 hydrates, and 1.23g (12 millimol) use of sodium bromides. A result is shown in Table 1.

[0022] It carried out by the same approach as an example 7 except having made example 8 reaction temperature into 15 degrees C. A result is shown in Table 1.

[0023] It carried out by the same approach as an example 1 except having carried out example 9 indan 7.5g (98.0% of purity, 0.062 mols), 0.82g (3.3 millimol) of cobaltous acetate (II)4 hydrates, 0.09g (0.37 millimol) of manganese acetate (II)4 hydrates, and 0.76g (7.4 millimol) use of sodium bromides. A result is shown in Table 1.

[0024] It carried out by the same approach as an example 1 except having carried out example 10 indan 15.3g (98.0% of purity, 0.127 mols), 1.69g (6.8 millimol) of cobaltous acetate (II)4 hydrates, 0.19g (0.76 millimol) of manganese acetate (II)4 hydrates, and 1.56g (15.2 millimol) use of sodium bromides. A result is shown in Table 1.

[0025] It carried out by the same approach as an example 2 except having made example 11 reaction temperature into 30 degrees C. A result is shown in Table 1.

It carried out by the same approach as an example 2 except having made example 12 reaction time into 8 hours. A result is shown in Table 1.

[0026] It carried out by the same approach as an example 2 except having made example 13 reaction time into 24 hours. A result is shown in Table 1.

It carried out by the same approach as an example 2 except having used 2-methyl indan 13.6g (97% of purity, 0.1 mols) as example 14 indans. A result is shown in Table 1.

[0027] It carried out by the same approach as an example 2 except having used 2-phenyl indan 20.2g (96% of purity, 0.1 mols) as example 15 indans, and having used 148g of acetic acids. A result is shown in Table 1.

It carried out by the same approach as an example 2 except having used 1-methoxy indan 15.3g (97% of purity, 0.1 mols) as example 16 indans, and having used 112g of acetic acids. A result is shown in Table 1.

[0028] It carried out by the same approach as an example 2 except having used 5 and-6-dimethoxy indan 18.6g (96% of purity, 0.1 mols) as example 17 indans, and having used 130g of acetic acids. A result is shown in Table 1.

It carried out by the same approach as an example 2 except having used cobalt bromide (II) 1.18g (5.4 millimol) as an example 18 cobalt-bromine compound. A result is shown in Table 1.

[0029] It carried out by the same approach as an example 2 except having used 1.58g (5.4 millimol) of cobalt (II) acetylacetonato dihydrates as example 19 cobalt compound. A result is shown in Table 1.

It carried out by the same approach as an example 2 except having used 0.17g (0.6 millimol) of manganese (II) acetylacetonato dihydrates as example 20 cobalt compound as 1.58g (5.4 millimol) of cobalt (II) acetylacetonato dihydrates, and a manganese compound. A result is shown in Table 1.

[0030] It carried out by the same approach as an example 1 except having carried out example of comparison 1 indan 25.0g (98.0% of purity, 0.212 mols), 2.84g (11.4 millimol) of cobaltous acetate (II)4 hydrates, 0.31g (1.3 millimol) of manganese acetate (II)4 hydrates, and 2.62g (25.4 millimol) use of sodium bromides. A result is shown in Table 1.

It carried out by the same approach as an example 2 except having made example of comparison 2 reaction temperature into 60 degrees C. A result is shown in Table 1.

[0031] It carried out by the same approach as an example 2 except having carried out 0.74g (3 millimol) use of 0.75g (3 millimol) of cobaltous acetate (II)4 hydrates, and manganese acetate (II)4 hydrates as example of comparison 3 catalyst. A result is shown in Table 1.

[0032]

表1-1

	使用原料			
	インダン類	コバルト化合物	マンガン化合物	臭素化合物
実施例 1	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 0.91g (8.8mmol)
実施例 2	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 3	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 0.90g (3.6mmol)	Mn (OAc) ₂ 4H ₂ O 0.10g (0.4mmol)	NaBr 0.82g (8mmol)
実施例 4	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.44g (5.8mmol)	Mn (OAc) ₂ 4H ₂ O 0.05g (0.2mmol)	NaBr 1.23g (12mmol)
実施例 5	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.39g (5.6mmol)	Mn (OAc) ₂ 4H ₂ O 0.10g (0.42mmol)	NaBr 1.23g (12mmol)
実施例 6	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.27g (5.1mmol)	Mn (OAc) ₂ 4H ₂ O 0.22g (0.9mmol)	NaBr 1.23g (12mmol)
実施例 7	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.20g (4.8mmol)	Mn (OAc) ₂ 4H ₂ O 0.29g (1.2mmol)	NaBr 1.23g (12mmol)
実施例 8	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.20g (4.8mmol)	Mn (OAc) ₂ 4H ₂ O 0.29g (1.2mmol)	NaBr 1.23g (12mmol)
実施例 9	インダン 7.5g (0.062mol)	Co (OAc) ₂ 4H ₂ O 0.82g (3.3mmol)	Mn (OAc) ₂ 4H ₂ O 0.09g (0.37mmol)	NaBr 0.76g (7.4mmol)
実施例 10	インダン 15.3g (0.127mol)	Co (OAc) ₂ 4H ₂ O 1.69g (6.8mmol)	Mn (OAc) ₂ 4H ₂ O 0.19g (0.76mmol)	NaBr 1.56g (15.2mmol)
実施例 11	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 12	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)

[0033]

表1-2

	仕 込 比			温 度	時 間	反応成績		
	インダン 濃度*	インダン類 /(Co+Mn) ^{2*}	Br-Co-Mn ^{3*}			転化率	選択率	インダン /(インダン+酢酸)
実施例 1	11.70 %	0.06	15-9-1	20	12	98.2	85.7	11.3
実施例 2	11.70 %	0.06	20-9-1	20	12	99.1	84.4	10.9
実施例 3	11.70 %	0.04	20-9-1	20	12	91.6	80.1	9
実施例 4	11.70 %	0.06	66-32-1	20	12	93.9	66.1	8.6
実施例 5	11.70 %	0.06	29-13-1	20	12	90.5	64.4	8
実施例 6	11.70 %	0.06	13-6-1	20	12	99.4	83.6	10.6
実施例 7	11.70 %	0.06	10-4-1	20	12	100	80.1	10.6
実施例 8	11.70 %	0.06	10-4-1	15	12	99.1	85.2	12.1
実施例 9	7.70 %	0.06	20-9-1	20	12	99.4	85.8	13.3
実施例 10	14.50 %	0.06	20-9-1	20	12	86.4	80.2	13.6
実施例 11	11.70 %	0.06	20-9-1	30	12	99.4	82.2	9.8
実施例 12	11.70 %	0.06	20-9-1	20	8	96	84.6	11.1

* : 100×インダン / (インダン+酢酸) 単位 : 重量%

2* : モル比

3* : 原子比

[0034]

表1-3

	使用原料			
	インダン類	コバルト化合物	マンガン化合物	臭素化合物
実施例 13	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 14	2-メチルインダン 13.6g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 15	2-フェニルインダン 20.2g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 16	1-メチルインダン 15.3g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 17	5,6-ジメチルインダン 18.8g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 18	インダン 12.0g (0.1mol)	CoBr ₂ 1.18g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	—
実施例 19	インダン 12.0g (0.1mol)	Co (acac) ₂ 2H ₂ O 1.58g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
実施例 20	インダン 12.0g (0.1mol)	Co (acac) ₂ 2H ₂ O 1.58g (5.4mmol)	Mn (acac) ₂ 2H ₂ O 0.17g (0.6mmol)	NaBr 1.23g (12mmol)
比較例 1	インダン 25.0g (0.21mol)	Co (OAc) ₂ 4H ₂ O 2.84g (11.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.31g (1.3mmol)	NaBr 2.62g (25.4mmol)
比較例 2	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 1.35g (5.4mmol)	Mn (OAc) ₂ 4H ₂ O 0.15g (0.6mmol)	NaBr 1.23g (12mmol)
比較例 3	インダン 12.0g (0.1mol)	Co (OAc) ₂ 4H ₂ O 0.75g (3mmol)	Mn (OAc) ₂ 4H ₂ O 0.74g (3mmol)	NaBr 1.23g (12mmol)

[0035]

表1-4

	仕 込 比			温 度	時 間	反応成績		
	インダン 濃度*	インダン類 /(Co+Mn) ^{2*}	Br-Co-Mn ^{3*}			転化率	選択率	インダン /インダン- <i>h</i>
実施例 13	11.70 %	0.06	20-9-1	20	24	99.3	82.1	10.1
実施例 14	13.00 %	0.06	20-9-1	20	12	98.2	85.1	11.4
実施例 15	12.00 %	0.06	20-9-1	20	12	95.1	80.7	9.5
実施例 16	12.00 %	0.06	20-9-1	20	12	96.9	83.6	10.7
実施例 17	12.50 %	0.06	20-9-1	20	12	94.6	81.8	8.8
実施例 18	11.70 %	0.06	18-9-1	20	12	98.2	84.8	11.3
実施例 19	11.70 %	0.06	20-9-1	20	12	98.6	84	10.4
実施例 20	11.70 %	0.06	20-9-1	20	12	97.1	83.1	10
比較例 1	21.70 %	0.06	20-9-1	20	12	55.8	33.2	2.1
比較例 2	11.70 %	0.06	20-9-1	60	12	100	2.1	—
比較例 3	11.70 %	0.06	2-1-1	20	12	100	0	—

* : 100×インダン / (インダン+酢酸) 単位 : 重量%

2* : モル比

3* : 原子比

[0036]

[Effect of the Invention] Since 1-Inn Danone can be obtained with a high invert ratio and high selectivity by specifying the indans concentration of the solution of the indans which are a raw material, and the amount of the catalyst used, and oxidizing in indans on mild conditions according to the approach of this invention, manufacture of 1-Inn Danone in a industrial scale is cheaply possible.

[Translation done.]